Optimization of a Diesel Hydrotreater Unit

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Sector: Refining

Why chose **ORTO** for this application?

The hydrotreating process is non-linear and non-stationary i.e., process dynamics change over time as catalyst activity deteriorates. Traditional model-based RTO technologies are not suited to such applications as they require extensive ongoing upkeep to maintain performance.

ORTO schemes however are easy to design and implement, significantly reducing the time, cost and expertise needed. Their self-learning nature implicitly handles non-linearity. Thus, sulfur content optimization is maintained without any ongoing upkeep burden.

The technology is also very scalable, enabling the optimization scheme to be expanded easily over time to achieve increased benefits.

Business Objective

Ultra-low sulfur diesel is produced using a hydrotreating unit. Sulfur is removed through reaction with hydrogen. To minimize operational costs, it is desirable to run the hydrotreater unit such that the final diesel product is at, or just below, the sulfur upper quality limit. Doing so prolongs catalyst life and potentially increases the unit's ability to process heavier crudes for longer between unit turnarounds.

Typical Optimization Objective Function

Prolong catalyst life by holding sulfur content in the final diesel product at or below a target e.g., 10 ppm.

By manipulating, within a permitted range:

- Fired heater process exit temperature
- Reactor bed and / or feed temperatures
- Hydrogen ratio to feed (dependant on regulatory control structure)

Subject to the following constraints:

- Product sulfur quality high limit
- Hydrogen supply valve opening limits
- Hydrogen recycle compressor limits

Solution

On a relatively simple hydrotreater unit, 3-4 agents will be sufficient. On larger more complex units, 5 or more agents may be required.

Benefits

Life extension of catalyst. Ability to process heavier crudes for longer between turnarounds.